REMARKS

As previously brought to the Examiner's attention, the prior Office Action failed to address or make reference to the status claim 24 in the Detailed Action. While the claim is addressed in the subject Office Action, as this is a first articulation of a basis for the rejection, such rejection is improperly made final. Accordingly, withdrawal of the finality of the outstanding Action is respectfully requested.

Addressing the substantive rejections, the claims are amended to more clearly describe the subject matter of the invention without prejudice to, disclaimer or surrender of Applicants's right to submit claims of the same or broader scope than originally filed or any other claims supported by the disclosure in a continuation application. Thus, to advance prosecution, the pending claims are amended to emphasize at least three features:

1. Heating of a corona electrode by application of a heating voltage to / current through the electrode

2. during a period when there is no high intensity electric field being generated (e.g., no high voltage is applied)

3. so as to reduce an oxidized portion of the electrodes to restore the original material.

The applied art fails to suggest, much less teach these features, alone or in combination, as is more fully set forth below. These features, as fully described in Applicants' disclosure, address materials, e.g., easily or readily oxidized metals, that may be used as corona electrodes while reducing ozone production. As the oxidation layer has an adverse effect on electrode operation over time, Applicants have found that heating the electrode by application of a high current causes the oxidized material to be reduced and restores the material to its original, non-oxidized state. To avoid problems that might be caused by thermal expansion of the electrodes due to heating, cleaning cycles are performed while high intensity field generation is suspended, e.g., a high corona discharge voltage is removed while a low voltage heating supply is connected to reduce the oxidized material and restore the original state of the material.

Rejection of Claims 1, 2, 4, 7, 10, 18, 19, 22, 23, 25, 27-30 and 34-38 over Hosaka '348

Claims 1, 4, 7, 10, 13, 18, 22, 25, 27-30 and 38

According to the Examiner, Hosaka teaches all of the elements of Claims 1, 4, 7, 10, 13, 18, 22, 25, 27-30 and 38 with the exception of producing an electric field and non-overlapping heating. The Examiner takes the position that not allowing electric field generation and heating to overlap would be obvious since "the heater can be turned on and maintained for a predetermined period of time." The Examiner further states that "[i]t would have been obvious to one of ordinary skill in the art at the time the invention was made to not have the step of producing a high intensity electric field and heating to overlap in order to prevent the overheating of the corona electrode during the removal of particulates/contaminants/oxides from the electrodes." However, Hosaka never mentions overheating and, therefore, the Examiner's reliance on such motivation for the necessary modification is misplaced.

Contrary to the Examiner's position, Hosaka neither teaches turning off a high voltage during heating nor that heating the electrodes removes particulates or contaminants. In fact, none of these words are found in the Hosaka patent at all. Hosaka does not describe or suggest removing or cutting the electric field. Instead, the patent describes reducing the electric field to a level that is still considered to be a high-intensity.

> *...the amplitude V_A of the alternating voltage 21 is 400V which is greater than a half of the critical voltage V_T for corona ion generation but less than the critical voltage V_T itself, so that the generation of the corona ions takes place only when the signal voltage V_S of negative polarity is applied to the signal electrodes 3 and when the signal voltage V_S is not applied to the signal electrodes 3 the corona ion generation does not take place.*

Hosaka, Column 11, lines 32 – 40.

Hosaka may reduce the field, but does not eliminate or suspend generation of a high intensity field as required by the rejected claims. This feature of the claims provides the advantages detailed in Applicants' disclosure:

> *Sagging wires may oscillate and either spark or create undesirable noise and sound. To prevent that, the electrode(s) may be stretched, e.g., biased by one or more springs to maintain tension on the wires. Alternatively or in addition, ribs may be employed and arranged to shorten wire parts and prevent oscillation. Still further, a corona generating high voltage may be decreased or removed during at least a portion of the time during which the electrode is heated. In this case, removal of the high voltage prevents wire oscillation and/or sparking.*

Paragraph [0038] of Applicants' Published Application 20050116166.

As Hosaka provides no description nor motivation for suspending a high intensity electric field or not allowing an overlap thereof with electrode heating, independent claims 1, 18, 22 and 38 rejected thereover are considered to be allowable.

Similar arguments for patentability apply to the dependent claims such as claim 4 that requires non-overlap of high and low voltages:

> *...wherein said step of producing a high intensity electric field includes applying a high voltage to said corona electrode sufficient to cause a corona discharge from said corona electrode and said step of heating includes applying a low voltage to said corona electrode, wherein said steps of applying said high voltage and said low voltage do not overlap.*

Other features recited by the rejected dependent claims are similarly absent from Hosaka. For example, claims 10 and 28 require monitoring an electrical resistivity of the corona electrode and, in response, heating the electrode. Independent claim 18 includes a similar requirement to detect an electrical characteristic of the corona electrodes as does dependent claim 27. Hosaka is, once again, silent on this feature as is to be expected since the patent fails to appreciate the formation of oxides on the electrodes or the reduction of the oxidized portions using heat.

Claims 2 and 23

Similarly, the rejection of claims 2 and 23 is not supported by Hosaka. While the Examiner takes the position that selection of one of the recited metals for use as a corona electrode would be obvious design choice, there is simply no support for such an assertion. To the contrary, it would seem that one of ordinary skill in the art would select an electrode material

that would *not* easily oxidize rather than one that would. Hosaka describes a tungsten electrode that is a very stable material and not prone to oxidation in an electric field, *not* one of a readily oxidizable metal selected from silver, lead, zinc and cadmium.

Claims 19 - 21

Claim 19 requires that heating of the corona electrodes be sequentially repeated with respect to each group of electrodes. This feature of the invention provides several advantages as detailed in applicantss' disclosure:

> *Power consumption and dissipation of heat generated by the process are issues that are addressed by embodiments of the present invention. Electrostatic devices employing a large number of corona electrodes would require a large amount of electrical power to be applied for proper electrode heating. In spite of the relatively short heating cycle duration necessary to clean the electrodes of contaminants and convert oxide layers back to their original compositions, this time, typically measured in seconds, is substantial and therefore a large and relatively expensive power supply may be required. Therefore, for large systems it may be preferred to divide the corona electrodes into several sections and heat each section in sequence. This would significantly decrease power consumption and, therefore, the cost of the heating arrangement and minimize peak power consumption. The sections may be separate groupings of electrodes or may include sets of electrodes interspersed among one-another to minimize heat buildup in any one portion of a device and provide for enhanced heat dissipation. Alternatively, grouping of electrodes of a particular section may provide more efficient thermal energy usage by minimizing heat loss and maximizing corona electrode temperature.*

Paragraph [0101] of applicantss' Published Application 20050116166.

The cited section of Hosaka at column 17, lines 1 - 48 and column 18, lines 10 2-5 does not appear applicable to this feature or that of claims 20 or 21. Accordingly, claims 19 – 21 are considered to be allowable thereover.

Claims 34 – 37

Finally, claims 34 – 37 are considered to be allowable over Hosaka, each describing subject matter not found in or suggested by the applied reference in the claimed combination.

Rejection of Claims 1 – 30 and 38 over Morita '816

Morita describes an ozonizer including an ozonizing discharge element for producing ozone and a separate heating element located on an opposite side of a distinct substrate layer from that of a discharge electrode. Heating of the discharge electrode by the heating element occurs during normal device operation, not only while the discharge electrode is not producing a high intensity electric field; the discharge element is not itself electrically heated by application of a low voltage heating electrical current; there is no teaching of using an electrode material that is readily oxidized so as to reduce ozone emissions (a feature that would be antithetical to the zone producing purpose of the device and possibly render it inoperative for its intended purpose) and, therefore, no description of heating the electrode to a sufficient temperature to reduce oxidation of the electrode. As detailed below, as the pending claims require one or more of these or similar features not described or suggested by Morita, the rejections are improper and withdrawal thereof is respectfully requested.

Claims 1, 4, 18, 22 and 38

The Examiner takes the position that while Morita "does not explicitly state" it does nonetheless teach non-overlapping of high electric field generation and electrode heating, citing to column 10, lines 34 – 36 of the disclosure and column 5, lines 8 – 13. However, at most, the cited passages suggest independent operation of the heating function, *not* controlling the operations to avoid overlapping. While the Examiner takes the position that one skilled in the art would know to avoid overlapping so as to prevent overheating, such a modification is neither taught nor suggested by Morita. To the contrary, the passages cited by the Examiner instead teach the use of a thermistor to control heating. Further, it would seem that modifying Morita as suggested by the Examiner might render the ozonizer inoperative for its intended purpose by failing to scatter ammonium nitrate molecules during actual operation of the discharge element.

Morita further fails to describe or suggest the method of or structure for applying a low voltage to the corona electrodes for resistively heating the electrodes. To the contrary, Morita details a separate resistive heating element that is located on an opposite side of stacked ceramic dielectric layers from that of a filamentary discharge electrode. Further, the separate heating and discharge elements are operated simultaneously, not in the alternative or in a non-overlapping manner as required by the claims.

Accordingly, the rejection of claims 1, 4, 18, 22 and 38 over Morita is considered to be improper and withdrawal thereof is respectfully requested.

Claims 2 and 23

The Examiner again takes the position that selection of a metal from the recited group is mere design choice. In response, applicantss again point out that one skilled in the art would tend to select a stable material for the corona element, one that was not easily oxidized. Morita fails to describe or provide the requisite motivation for employing a readily oxidizable material or metal as recited by the rejected claims and, therefore, fails to render those claims obvious. According, withdrawal of the outstanding rejection of claims 2 and 23 in view of Morita is respectfully requested.

Claims 3 and 24

Claims 3 and 24 stand rejected over Morita, the examiner citing to the abstract, column 4, lines 45 – 65 and column 16, lines 29 – 45. However, there appears to be no description or suggestion in the cited passages for the claimed feature including:

> *[heating] said corona electrode ... to attain a temperature T sufficient for deoxidation of a material forming said corona electrode*

Claim 3 as amended;

> *[heating] said corona electrodes to attain a temperature T sufficient for deoxidation of said corona electrodes and given by the equation*

$$T > \Delta H^{o}_{rxn} / \Delta S^{o}_{rxn}$$

where ΔH^{o}_{rxn} is the standard state enthalpy (Dhorxn) and ΔS^{o}_{rxn} is the standard state entropy changes for the oxidation process of a surface material of said corona electrode

Claim 24 as amended.

Accordingly, claims 3 and 24 are considered to be patentably distinct and nonobvious in view of Morita.

Claim 9

The Examiner admits that Morita fails to teach a corona electrode made of a material that oxidizes under the influence or air, but holds that this would be a mere matter of design choice. Again, Applicants disagree for the reasons presented above. This feature of the claim reduces ozone generation, something not mentioned by and contrary to the intended use by Morita. Morita is directed toward generating ozone such that use of a readily oxidizable metal is further contraindicated and might even render the Morita device inoperative. Further, use of such an oxidizable metal would not be appropriate in the water purified environment described by Morita where rust is a greater problem than in air. Still further, absent Applicants' teaching of heating to rehabilitate the electrode, one skilled in the art would be dissuaded from employing an oxidizable material as a corona electrode, the prior art, if anything, teaching away from using such materials.

For the reasons presented, claim 9 is considered to be allowable over the applied art of record.

Claims 10 – 12 and 14

Again, the Examiner's position that Morita describes or suggests the claimed subject matter is not supported by the cited portions of the disclosure nor elsewhere. Certainly, controlling heating using a thermistor that is responsive to a thermal parameter (temperature) to regulate temperature is fundamentally different from monitoring an electrical characteristic of an electrode to determine when to discontinue normal operations and initiate a heating mode to mitigate an impurity. Accordingly, the rejection of claims 10 -12 and 14 in view of Morita is believed to be improper and withdrawal thereof is respectfully requested.

Claims 13, and 15 – 17

The Examiner cites to passages of Morita for teaching detecting a predetermined electrical characteristic of the corona electrode and, in response heating the electrode; measuring a period of time since last heating cycle and, in response, heating the electrode; and for terminating producing a high intensity field, heating the electrode and, afterwards, reinitiating production of the high intensity field. However, the cited passages appear to, at most, instead describe turning the unit off when a cover is removed, heating to achieve a predetermined temperature within a range of 200° C to of 500° C, using a thermistor to control heating, and timer control of an ozone generating element. Nowhere is there any description or suggestion for heating in response to detecting a predetermined electrical characteristic of the corona electrode, heating controlled by a timer, periodic heating after a lapse of some time period, or heating during a suspension of producing a high-intensity electric field. Accordingly, the outstanding rejection of claims 13 and 15 – 17 is improper and withdrawal thereof is requested.

Claims 20 and 21

The Examiner takes the position that the subject matter of these claims would be obvious without the citation of any support. The rejection is respectfully traversed. The mere fact that a modification could have been made or a feature incorporated does not render that feature obvious. Applicants' invention includes electrical heating of elements that may require significant electrical power. However, suggesting that such a modification is obvious based on

hindsight reconstruction is improper. Withdrawal of the rejections of claims 20 and 21 is respectfully requested.

Claim 22

Although discussed above, for purposes of conforming the present Remarks to the order presented in the Office Action, claim 22 is again addressed. As previously mentioned, Morita fails to describe or suggest a low voltage power supply connected to the corona electrodes for resistively heating the electrodes in favor of separate heating and discharge elements. Further, it appears that the Examiner has overlooked the precise wording of claim 22 in formulating the rejection. Rather than merely requiring selectively connecting the high and low voltage power supplies to the corona electrodes, the claim recites "***alternatively***" applying the voltages. Thus, either one voltage or the other is applied, but not both. Morita fails to teach or suggest such a feature and therefore fails to defeat patentability of claim 22.

Claims 25 - 31

Morita further fails to describe of suggest the subject matter of claim 25 – 31, each dependent from claim 22. Each of these claims is considered to be patentable both as dependent from the allowable subject matter of base claim 22 and by the respective recitation of additional feature not taught or suggested by the applied reference.

For example, claim 25 requires, in response to a timer, interrupting application of a high voltage power to the corona electrodes, applying a low voltage (for resistively heating the electrodes) and, subsequently, resuming application of the high voltage. As Morita fails to disclose application of a low voltage current to a corona electrode for resistively heating the electrode, it is to be expected that the disclosure further fails to describe or suggest use of a timer to provide for an alternating application of low and high voltages to the electrodes.

Similarly, Morita is completely devoid of any means for detecting an electrical characteristic indicative of an oxidation of a corona electrode as require by claim 27. Again, this is expected since Morita would *not* use electrode materials that readily oxidize to reduce or

eliminate ozone production (Morita is directed *toward* producing ozone, not eliminating it) and, therefore, would not have a need to monitor for oxidation. Accordingly, it is further to be expected that Morita would fail to suggest the structure of claims 29 – 31 for providing electrical power for resistively heating the corona electrodes to reduce oxidation of the electrodes.

Claims 32 - 34

The rejection of claims 32 – 34 is respectfully traversed for the reasons given above and for the following additional reasons.

While the Examiner takes the position that Morita discloses all claim limitations except for a suitable temperature, Applicants respectfully disagree. For example, Morita fails to describe or suggest converting a portion of a corona electrode using a chemical reaction that decreases generation of a corona discharge by-product. As detailed above, Morita is concerned with generating ozone, not providing a mechanism to inhibit its production. Therefore it is to be expected that Morita would use a non-reactive or inert electrode material. In any case Morita appears to omit any details about suitable electrode materials.

The Examiner's reliance on Rodden is also misplaced. The disclosure states that "...heat suppresses ozone generation by converting some product ozone back to oxygen." However, this is a different mechanism than that used by embodiments of Applicants' device so as to reduce ozone production. Instead, Applicants have described use of a readily oxidizable corona electrode material to reduce ozone production. Applicants teach the use of heat to reverse the oxidation of the electrode material, not to directly convert ozone back to molecular oxygen. Thus, Rodden fails to describe or suggest the features of claim 32 including:

> *"heating the corona electrode to a temperature sufficient to substantially restore the converted part of the corona electrode material back to the initial corona electrode material"*

Rodden never discusses heating an electrode to restore the electrode material, only that heat converts ozone back to oxygen. Accordingly, claim 32 is considered to be patentable thereover.

Claims 33 and 34 are both considered to describe patentable subject matter as dependent upon the allowable subject matter of claim 32 and as each described additional subject matter not found in or suggested by the applied art. For example, claim 33 specifies that the chemical reaction specifically decreases ozone as a by-product. Neither Morita nor Rodden describe or suggest as such. Similarly, claim 34 requires application of an electric current to heat the corona electrode. Morita heats only indirectly while Rodden not at all.

The rejections based on the combination of Morita and Rodden are further considered to be improper for lack of motivation for making the combination and modifying Morita according to Rodden. The Examiner describes that there would be advantages to making a combination according to the rejected claims but the references themselves are silent on this point. This is not surprising since it appears that the references never contemplate nor do they describe a method or structure to *reduce* ozone production by providing a readily oxidizable corona electrode and then restoring the electrode by heating.

Conclusion

In view of the above amendment, applicants believes the pending application is in condition for allowance. As the present amendment places the application in condition for allowance without necessitating further consideration or search or, in the alternative, presents the claims in better form for appeal, entry of this amendment in accordance with 37 CFR §1.116 is respectfully requested.

A check in the amount of $120.00 is enclosed in support of a Petition for a One-Month Extension of Time .

If any other or additional fee is due, please charge our Deposit Account No. 06-2375, under Order No. 432.010 from which the undersigned is authorized to draw.

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Respectfully submitted,

By _____

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